Electronic Version

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Description

BI-LATERAL BODY WEIGHT SUPPORT SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a Continuation Application of Application No. 09/791,166 filed 02/22/2001 which claims the benefit of US Provisional Application No. 60/184,134 filed 02/22/2000. Said applications are hereby expressly incorporated by reference in their entireties into the present application.

BACKGROUND OF INVENTION

[0002]

Apparatus for supporting all or a portion of a subject's body weight during therapy are known. Reference is made to the WOODWAY Loko SystemÂ® illustrated in FIG. 1. The WOODWAY system employs a single pair of cable assemblies 100 supported by fixed support arms 110 which extend over a treadmill 120. The support arms 110 maintain the cable assemblies 100 at a fixed distance apart. The ability to tailor the distance between the cables 100 to the particular subject 140 is not provided. Each cable assembly 100 incorporates a winch 130 for assisting in initial positioning of the subject 140 and a scale 150 for estimating the subject's 140 weight. Hoisting the subject 140 into position requires coordinated operation of the manual winches 130 by

an operator 160. Determining the weight of the subject 140 requires that the subject 140 remain still over the period of time required to consult both scales 150. The illustrated system provides only a hard limit support at the full extension of the scales 150 and employs the scales 150 in a support role not typically intended for commercially available scales of the type illustrated. As illustrated it is apparent that the therapist(s) 160 will typically attend the subject 140 during use of the equipment. In order to control either the treadmill 120 or the support apparatus, a therapist/operator 160 would have to divert their attention away from the subject 140.

[0003] Reference is also made to Applicant's pending application for U.S. Patent Application No. 09/021,554 for EXERCISE AND REHABILITATION APPARATUS AND METHOD filed February 10, 1998, which is hereby fully incorporated by reference. In the referenced application, an exercise and therapeutic device providing a subject with support via a pneumatic spring assembly is disclosed. The pneumatic spring assembly overcomes drawbacks of hard limit body weight support devices such as the WOODWAY device. The invention of the referenced application also provides an operator with control of pneumatic pressure, but as with control of the treadmill in the WOODWAY system, a therapist operator would have to divert their attention away from the subject.

[0004] In light of the characteristics of the background art described above, there exists a need for a body weight support apparatus which

provides: improved ability to hoist the subject into and out of position; improved weight measurement; variable separation between support cables; and a degree of control of the treadmill and support apparatus without a therapist/operator having to divert attention away from the subject.

SUMMARY OF INVENTION

[0005] In the disclosed embodiment, the present invention alleviates the drawbacks described above with respect to the known body weight support systems.

[0006] The body weight support apparatus of the current invention consists of a frame; a hoist subsystem attached to the frame and operable for positioning a subject on the treadmill; a two-cable pneumatic spring support subsystem also attached to said frame and operable for providing bilateral resilient support to a subject on the treadmill; a frame orientation control subsystem attached to the frame and adapted to control the distance between the support cables.

[0007] The general beneficial effects described above apply generally to each of the exemplary descriptions and characterizations of the devices and mechanisms disclosed herein. The specific structures through which these benefits are delivered will be described in detail hereinbelow.

BRIEF DESCRIPTION OF DRAWINGS

[0008] In the following, the invention will be described in greater detail by way of examples and with reference to the attached drawings, in which:

[0009] Figure 1 is an illustration of the Woodway background art device.

[0010] Figure 2 is a perspective view of the present invention.

[0011] Figure 3 is a perspective view of the present invention.

[0012] Figure 4 is a detailed view of the screw assembly and control bar of the present invention.

[0013] Figure 5 is a detailed view of the cable separation indicator of the present invention.

[0014] Figure 6 is a detailed view of the screw assembly of the present invention.

[0015] Figure 7 is a detailed view of the lower hoist rope pulley with slave cylinder of the present invention.

[0016] Figure 8 is a view of the interface panel of the voice control of the present invention.

[0017] Figure 9 is a perspective view of an alternative embodiment of the present invention.

[0018] Figure 10 is a view of the attachment means for attaching the struts to the frame.

DETAILED DESCRIPTION

[0019] As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be

embodied in various and alternative forms. The figures are not necessarily to scale; some features may be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention.

[0020] Furthermore, elements may be recited as being "coupled"; this terminology's use contemplates elements being connected together in such a way that there may be other components interstitially located between the specified elements, and that the elements so specified may be connected in fixed or movable relation one to the other. Certain components may be described as being "adjacent" to one another. In these instances, it is expected that a relationship so characterized shall be interpreted to mean that the components are located proximate to one another, but not necessarily in contact with each other. Normally there will be an absence of other components positioned therebetween, but this is not a requirement. Still further, some structural relationships or orientations may be designated with the word "substantially". In those cases, it is meant that the relationship or orientation is as described, with allowances for variations that do not effect the cooperation of the so described component or components.

[0021] Referring to FIGURES 2 through 7, a preferred embodiment of the bilateral body weight support 200 of the present invention is shown.

The illustrated embodiment consist of (1) a frame and (2) a hoist, support, and control (HSC) assembly.

[0022] The frame consists of a base 210, two fixed members 220, 221; two movable angled members 230, 235, and accompanying struts 240, 241, 242, 243. The base 210 is a ladder frame adapted to extend horizontally under a treadmill 120. The two (2) fixed members 220, 221 are attached at opposite sides of the base 210 near one end of the base 210 and oriented substantially vertical. Supplemental support to is provided by two (2) first struts 240, 241 each extending from the base 210 to a point on a corresponding fixed member 220, 221. Each movable angled member 230, 235 consists of a lower portion 231, 236 substantially coaxial with the axis of a corresponding fixed member 220, 221and an upper portion 232, 237 extending over the base 210. The movable angled members 230, 235 are adapted to be pivotable about the axis of the angled member's 230, 235 lower portion 231, 236. Two (2) second struts 242, 243 provide supplementary support to corresponding movable angled members 230, 235 by extending from a point on a movable angled member's 230, 235 upper portion 232, 237 to a point on that movable angled members 230, 235 corresponding fixed member 220, 221.

[0023] The HSC assembly consists of an housing 340, a hoist subsystem, a pneumatic spring support subsystem, and an angled members orientation control subsystem. The operation of individual support cables 300, 301 in conjunction with a pneumatic spring is described in

detail in Applicant's pending application for U.S. Patent Serial No. 09/021,554. Generally, a pneumatic spring in conjunction with support cables 300, 301, provides resilient support to the subject 140 during use of a treadmill 120. The pneumatic spring support subsystem of the current invention removes the need for the spreader bar disclosed in the pending application by using a pair of support cables 300, 301 connected to a pair of independent pneumatic springs. In the present invention, the pneumatic springs are deployed within the fixed 220, 221 of the frame. Each support cable 300, 301, in mechanical communication with its corresponding pneumatic spring is threaded through its corresponding fixed and angled frame members 220, 221, 230, 235 then over a support cable pulley 320, 321 disposed near the distal end of the angled members 230, 235. Each support cable 300, 301 is terminated with hardware suitable for attaching the support cable to a harness to be worn by the subject 140. One pneumatic spring support subsystem measurement device 330, 331, adapted to display a measurement corresponding to the pressure in each pneumatic spring interfaces with each pneumatic spring. The pneumatic spring support subsystem measurement devices 330, 331and associated interface hardware are contained within the housing 340.

[0024]

The hoist subsystem includes a pair of hoist ropes 350, 351, a winch 380, a scale 380, three (3) sets of pulleys 306A, 360B, 361, 362 and associated interconnection hardware. In the illustrated embodiment, a manually operated winch 370, mounted in conjunction with the HSC

housing 340, holds two (2) lengths of hoist rope 350, 351 which are disposed around two double-channel pulleys 361, 362 mounted at the interior face of the HSC housing 340. One of the double channel pulleys 361 is connected to a slave cylinder in communication with the scale 380 for indicating the tension applied to the hoist ropes 350, 351. The slave cylinder arrangement is illustrated in FIG. 7. Each hoist rope 350, 351 is further disposed around a separate single-channel pulley 360A, 360B at the distal end of each movable angled members 230, 235. Each hoist rope 350, 351 is terminated with hardware suitable for attaching the hoist rope 350, 351 to a harness worn by the subject 140.

[0025]

The angled members orientation control subsystem includes a screw assembly 370, a control plate 371, and two (2) control struts 372, 373. The screw assembly 370 is mounted within the housing 340 and is in mechanical communication with the control plate 371 at one end of the control plate 371. The control plate 371 is pivotally affixed to a face of the housing 340 at a second end of the control plate distal from the screw assembly 370. At the control plate end adjacent the screw assembly 370, the control plate 371 is captively engaged with the screw assembly 370 threads so that as the screw is rotated in one direction the control plate 371 pivots counterclockwise about its distal pivot point; and as the screw is rotated in an opposite direction the control plate 371 pivots clockwise about its distal pivot point. Two control struts 372, 373 are pivotally attached to the control plate 371. Each control strut 372, 373 extends to the distal end of separate movable angle members

230, 235 where it is pivotally attached so as not to interfere with operation of the pulleys 320, 321, 360A, 360B also attached at the distal end of that movable angled members 230, 235. As the control plate 371 pivots in a first direction, the distal ends of the movable angled members 230, 236 are forced to separate. As the control plate 371 pivots in a second opposite direction, the distal ends of the movable angled members 230, 235 are forced to come closer to one another. The distance between the distal ends of the movable angled members 230, 235 is free to change because each movable angled members 230, 235 is rotatable about the central axis of its lower portion 231, 236. In the illustrated embodiment, a scale 380 is provided on the HSC housing 340 to indicate to approximate distance between the distal ends of the movable angled members 230, 235.

[0026]

Referring to Figures 8, in another embodiment of the present invention, voice control of the treadmill 1 20 and body weight support apparatus is provided. Voice control may be of the type which requires training of the voice control system, or of the type which requires no training. In the instant embodiment, voice control is implemented using an off-the-shelf voice control module and attendant interface circuitry and hardware. Voice control has been implemented in the current invention to provide both gross and vernier adjustment of treadmill 120 speed, treadmill 120 inclination, support cable tension, and support cable deployed length. Voice control of support cable tension and support cable deployed length has been implemented in the instant invention for individual

support cables and jointly for the pair of support cables.

[0027] Referring to Figure 9, a separate embodiment of the current invention is shown as a single pole body weight support apparatus.

[0028] Although the present invention has been described and illustrated in detail, it is to be clearly understood that the same is by way of illustration and example only, and is not to be taken as a limitation. The spirit and scope of the present invention are to be limited only by the terms of any claims presented hereafter.

[0029] INDUSTRIAL APPLICABILITY: The present invention relates to exercise and therapeutic equipment; and more particularly, to exercise and therapeutic devices that support all or a portion of a person's weight for permitting therapeutic and training sessions that would otherwise be difficult or impossible for the subject to perform, if subject were required to support his or her entire weight.